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$P_{W,SB}$, in which case no separate measurement of off mode power is necessary. The recorded off mode power ($P_{W,OFF}$) shall be rounded to the second decimal place, and for loads greater than or equal to 10W, at least three significant figures shall be reported.

4.0 * * *

4.6.3 *Average annual auxiliary electrical energy consumption for vented heaters.* For vented heaters with single-stage controls or manual controls, the average annual auxiliary electrical consumption (E_{AE}) is expressed in kilowatt-hours and defined as:

$$E_{AE} = BOH_{SS}P_E + E_{SO}$$

Where:

BOH_{SS} = as defined in 4.6.1 of this appendix

P_E = as defined in 3.1.3 of this appendix

E_{SO} = as defined in 4.7 of this appendix

4.6.3.1 For vented heaters with two-stage or modulating controls, E_{AE} is defined as:

$$E_{AE} = (BOH_R + BOH_H)P_E + E_{SO}$$

Where:

BOH_R = as defined in 4.6.1 of this appendix

BOH_H = as defined in 4.6.1 of this appendix

P_E = as defined in 3.1.3 of this appendix

E_{SO} = as defined in 4.7 of this appendix

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4.7 *Average annual electric standby mode and off mode energy consumption.*

Calculate the annual electric standby mode and off mode energy consumption, E_{SO} , defined as, in kilowatt-hours:

$$E_{SO} = ((P_{W,SB} * (4160 - BOH)) + (P_{W,OFF} * 4600)) * K$$

Where:

$P_{W,SB}$ = vented heater standby mode power, in watts, as measured in section 3.7 of this appendix

4160 = average heating season hours per year

$P_{W,OFF}$ = vented heater off mode power, in watts, as measured in section 3.7 of this appendix

4600 = average non-heating season hours per year

K = 0.001 kWh/Wh, conversion factor for watt-hours to kilowatt-hours

BOH = burner operating hours as calculated in section 4.6.1 of this appendix where for single-stage controls or manual controls vented heaters $BOH = BOH_{SS}$ and for vented heaters equipped with two-stage or modulating controls $BOH = (BOH_R + BOH_H)$.

APPENDIX P TO SUBPART B OF PART 430—UNIFORM TEST METHOD FOR MEASURING THE ENERGY CONSUMPTION OF POOL HEATERS

1. *Test method.* The test method for testing pool heaters is as specified in American Na-

tional Standards Institute Standard for Gas-Fired Pool Heaters, Z21.56-1994.

2. *Test conditions.* Establish the test conditions specified in section 2.9 of ANSI Z21.56-1994.

3. *Measurements.* Measure the quantities delineated in section 2.9 of ANSI Z21.56-1994. The measurement of energy consumption for oil-fired pool heaters in Btu is to be carried out in appropriate units, e.g., gallons.

4. *Calculations*

4.1 *Thermal efficiency.* Calculate the thermal efficiency, E_t (expressed as a percent), as specified in section 2.9 of ANSI Z21.56-1994. The expression of fuel consumption for oil-fired pool heaters shall be in Btu.

4.2 *Average annual fossil fuel energy for pool heaters.* The average annual fuel energy for pool heater, E_F , is defined as:

$$E_F = BOH Q_{IN} + (POH - BOH)Q_P$$

where:

BOH =average number of burner operating hours=104 h

POH =average number of pool operating hours=4464 h

Q_{IN} =rated fuel energy input as defined according to 2.9.1 or 2.9.2 of ANSI Z21.56-1994, as appropriate

Q_P =energy consumption of continuously operating pilot light if employed, in Btu/h.

4.3 *Average annual auxiliary electrical energy consumption for pool heaters.* The average annual auxiliary electrical energy consumption for pool heaters, E_{AE} , is expressed in Btu and defined as:

$$E_{AE} = BOH PE$$

where:

$PE = 2E_c$ if heater tested according to 2.9.1 of ANSI Z21.56-1994

=3.412 PE_{rated} if heater tested according to 2.9.2 of ANSI Z21.56-1994, in Btu/h

E_c =Electrical consumption of the heater (converted to equivalent unit of Btu), including the electrical energy to the recirculating pump if used, during the 30-minute thermal efficiency test, as defined in 2.9.1 of ANSI Z21.56-1994, in Btu per 30 min.

2=Conversion factor to convert unit from per 30 min. to per h.

PE_{rated} =nameplate rating of auxiliary electrical equipment of heater, in Watts

BOH =as defined in 4.2 of this appendix

4.4 *Heating seasonal efficiency.*

4.4.1 Calculate the seasonal useful output of the pool heater as:

$$E_{OUT} = BOH [(E_t/100)(Q_{IN} + PE)]$$

where:

BOH =as defined in 4.2 of this appendix

E_t =thermal efficiency as defined in 4.1 of this appendix

Q_{IN} =as defined in 4.2 of this appendix

PE=as defined in 4.3 of this appendix

100=conversion factor, from percent to fraction

4.4.2 Calculate the seasonal input to the pool heater as:

$$E_{IN}=BOH (Q_{IN}+PE)+(POH-BOH) Q_P$$

where:

BOH=as defined in 4.2 of this appendix

Q_{IN} =as defined in 4.2 of this appendix

PE=as defined in 4.3 of this appendix

POH=as defined in 4.2 of this appendix

Q_P =as defined in 4.2 of this appendix

4.4.3 Calculate the pool heater heating seasonal efficiency (in percent).

4.4.3.1 For pool heaters employing a continuous pilot light:

$$EFFY_{HS}=100(E_{OUT}/E_{IN})$$

where:

E_{OUT} =as defined in 4.4.1 of this appendix

E_{IN} =as defined in 4.4.2 of this appendix

100=to convert a fraction to percent

4.4.3.2 For pool heaters without a continuous pilot light:

$$EFFY_{HS}=E_t$$

where:

E_t =as defined in 4.1 of this appendix.

[62 FR 26165, May 12, 1997]

EFFECTIVE DATE NOTE: At 77 FR 74572, Dec. 17, 2012, appendix P to subpart B of part 430 was revised, effective Jan. 16, 2013. For the convenience of the user, the revised text is set forth as follows:

APPENDIX P TO SUBPART B OF PART 430—UNIFORM TEST METHOD FOR MEASURING THE ENERGY CONSUMPTION OF POOL HEATERS

NOTE: The procedures and calculations that refer to standby mode and off mode energy consumption (i.e., sections 2.2, 2.3, 3.2, 4.2, 4.3, 5.3 equation (3), and 5.4 of this appendix P) need not be performed to determine compliance with energy conservation standards for pool heaters at this time. However, on or after June 17, 2013, any representations related to standby mode and off mode energy consumption of these products must be based upon results generated under this test procedure, consistent with the requirements of 42 U.S.C. 6293(c)(2). For pool heaters, the statute requires that after July 1, 2010, any adopted energy conservation standard shall incorporate standby mode and off mode energy consumption, and upon the compliance date for such standards, compliance with the applicable provisions of this test procedure will also be required.

1. Definitions.

1.1 *Active mode* means the condition during the pool heating season in which the pool

heater is connected to the power source, and the main burner, electric resistance element, or heat pump is activated to heat pool water.

1.2 *IEC 62301* (Second Edition) means the test standard published by the International Electrotechnical Commission, titled “Household electrical appliances—Measurement of standby power,” Publication 62301, Edition 2.0 2011–01. (incorporated by reference; see § 430.3)

1.3 *Off mode* means the condition during the pool non-heating season in which the pool heater is connected to the power source, and neither the main burner, electric resistance elements, nor heat pump is activated.

1.4 *Seasonal off switch* means a switch present on the pool heater that effects a difference in off mode energy consumption as compared to standby mode energy consumption.

1.5 *Standby mode* means the condition during the pool heating season in which the pool heater is connected to the power source, and neither the main burner, electric resistance elements, nor heat pump is activated.

2. Test Method.

2.1 *Active mode.* The test method for testing pool heaters in active mode is as specified in section 2.10 of ANSI Z21.56 (incorporated by reference; see § 430.3).

2.2 *Standby mode.* The test method for testing the energy consumption of pool heaters in standby mode is as described in sections 3 through 5 of this appendix.

2.3 Off mode.

2.3.1 Pool heaters with a seasonal off switch.

For pool heaters with a seasonal off switch, no off-mode test is required.

2.3.2 Pool heaters without a seasonal off switch.

For pool heaters without a seasonal off switch, the test method for testing the energy consumption of the pool heater is as described in sections 3 through 5 of this appendix.

3. Test conditions.

3.1 *Active mode.* Establish the test conditions specified in section 2.10 of ANSI Z21.56 (incorporated by reference; see § 430.3).

3.2 *Standby mode and off mode.* Following the conclusion of the 30-minute active mode test described in section 2.10 of ANSI Z21.56 (incorporated by reference; see § 430.3), reduce the thermostat setting to a low enough temperature to put the pool heater into standby mode. Operate the pool heater in standby mode for 60 minutes.

4. Measurements.

4.1 *Active mode.* Measure the quantities delineated in section 2.10 of ANSI Z21.56 (incorporated by reference; see § 430.3). The measurement of energy consumption for oil-fired pool heaters in Btu is to be carried out in appropriate units (e.g., gallons).

4.2 *Standby mode.* Record the average electric power consumption during the standby mode test, $P_{w,SB}$, in W, in accordance with

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section 5 of IEC 62301 (Second Edition) (incorporated by reference; see §430.3) and the fossil fuel energy consumption during the standby test, Q_p , in Btu. Ambient temperature and voltage specifications of ANSI Z21.56 (incorporated by reference; see §430.3) shall apply to this standby mode testing. The recorded standby power ($P_{W,SB}$) shall be rounded to the second decimal place, and for loads greater than or equal to 10W, at least three significant figures shall be reported.

4.3 Off mode.

4.3.1 *Pool heaters with a seasonal off switch.* For pool heaters with a seasonal off switch, the average electric power consumption during the off mode, $P_{W,OFF} = 0$, and the fossil fuel energy consumed during the off mode, $Q_{off} = 0$.

4.3.2 *Pool heaters without a seasonal off switch.* Record the average electric power consumption during the standby/off mode test, $P_{W,OFF}$ ($= P_{W,SB}$), in W, in accordance with section 5 of IEC 62301 (Second Edition) (incorporated by reference; see §430.3), and the fossil fuel energy consumption during the off mode test, Q_{off} ($= Q_p$), in Btu. Ambient temperature and voltage specifications of ANSI Z21.56 (incorporated by reference; see §430.3) shall apply to this off mode testing. The recorded off mode power ($P_{W,OFF}$) shall be rounded to the second decimal place, and for loads greater than or equal to 10W, at least three significant figures shall be reported.

5. Calculations.

5.1 *Thermal efficiency.* Calculate the thermal efficiency, E_t (expressed as a percent), as specified in section 2.10 of ANSI Z21.56 (incorporated by reference; see §430.3). The expression of fuel consumption for oil-fired pool heaters shall be in Btu.

5.2 *Average annual fossil fuel energy for pool heaters.* The average annual fuel energy for pool heaters, E_F , is defined as:

$$E_F = BOH Q_{IN} + (POH - BOH)Q_{PR} + (8760 - POH) Q_{off,R}$$

Where:

BOH = average number of burner operating hours = 104 h

POH = average number of pool operating hours = 4464 h

Q_{IN} = rated fuel energy input as defined according to section 2.10.1 or section 2.10.2 of ANSI Z21.56, as appropriate.

Q_{PR} = average energy consumption rate of continuously operating pilot light, if employed, ($= Q_p/1$ h)

Q_p = energy consumption of continuously operating pilot light, if employed, as measured in section 4.2 of this appendix, in Btu

8760 = number of hours in one year

$Q_{off,R}$ = average off mode fossil fuel energy consumption rate = $Q_{off}/(1$ h)

Q_{off} = off mode energy consumption as defined in section 4.3 of this appendix

5.3 *Average annual auxiliary electrical energy consumption for pool heaters.* The average annual auxiliary electrical energy consumption for pool heaters, E_{AE} , is expressed in Btu and defined as:

$$(1) E_{AE} = E_{AE,active} + E_{AE,standby,off}$$

$$(2) E_{AE,active} = BOH * PE$$

$$(3) E_{AE,standby,off} = (POH - BOH) P_{W,SB}(\text{Btu/h}) + (8760 - POH) P_{W,OFF}(\text{Btu/h})$$

Where:

$E_{AE,active}$ = auxiliary electrical consumption in the active mode

$E_{AE,standby,off}$ = auxiliary electrical consumption in the standby mode and off mode

PE = $2E_c$, if heater is tested according to section 2.10.1 of ANSI Z21.56, in Btu/h = $3.412 P_{E,rated}$, if heater is tested according to section 2.10.2 of ANSI Z21.56, in Btu/h

E_c = electrical consumption of the heater (converted to equivalent unit of Btu), including the electrical energy to the recirculating pump if used, during the 30-minute thermal efficiency test, as defined in section 2.10.1 of ANSI Z21.56, in Btu per 30 min.

2 = conversion factor to convert unit from per 30 min. to per h.

$P_{E,rated}$ = nameplate rating of auxiliary electrical equipment of heater, in Watts

BOH = as defined in 5.2 of this appendix

POH = as defined in 5.2 of this appendix

$P_{W,SB}$ (Btu/h) = electrical energy consumption rate during standby mode expressed in Btu/h = $3.412 P_{W,SB}$, Btu/h

$P_{W,SB}$ = as defined in 4.2 of this appendix

$P_{W,OFF}$ (Btu/h) = electrical energy consumption rate during off mode expressed in Btu/h = $3.412 P_{W,OFF}$, Btu/h

$P_{W,OFF}$ = as defined in 4.3 of this appendix

5.4 Integrated thermal efficiency.

5.4.1 Calculate the seasonal useful output of the pool heater as:

$$E_{OUT} = BOH[(E_t/100)(Q_{IN} + PE)]$$

Where:

BOH = as defined in 5.2 of this appendix

E_t = thermal efficiency as defined in 5.1 of this appendix

Q_{IN} = as defined in 5.2 of this appendix

PE = as defined in 5.3 of this appendix

100 = conversion factor, from percent to fraction

5.4.2 Calculate the annual input to the pool heater as:

$$E_{IN} = E_F + E_{AE}$$

Where:

E_F = as defined in 5.2 of this appendix

E_{AE} = as defined in 5.3 of this appendix

5.4.3 Calculate the pool heater integrated thermal efficiency (TE_i) (in percent).

$$TE_i = 100(E_{OUT}/E_{IN})$$

Where:

E_{OUT} = as defined in 5.4.1 of this appendix

E_{IN} = as defined in 5.4.2 of this appendix

100 = conversion factor, from fraction to percent

APPENDIX Q TO SUBPART B OF PART 430—UNIFORM TEST METHOD FOR MEASURING THE ENERGY CONSUMPTION OF FLUORESCENT LAMP BALLASTS

Comply with Appendix Q until November 14, 2014. After this date, all fluorescent lamp ballasts shall be tested using the provisions of Appendix Q1.

1. Definitions

1.1 *AC control signal* means an alternating current (AC) signal that is supplied to the ballast using additional wiring for the purpose of controlling the ballast and putting the ballast in standby mode.

1.2 *ANSI Standard* means a standard developed by a committee accredited by the American National Standards Institute.

1.3 *Ballast input voltage* means the rated input voltage of a fluorescent lamp ballast.

1.4 *DC control signal* means a direct current (DC) signal that is supplied to the ballast using additional wiring for the purpose of controlling the ballast and putting the ballast in standby mode.

1.5 *F40T12 lamp* means a nominal 40 watt tubular fluorescent lamp which is 48 inches in length and one and a half inches in diameter, and conforms to ANSI C78.81 (Data Sheet 7881-ANSI-1010-1) (incorporated by reference; see § 430.3).

1.6 *F96T12 lamp* means a nominal 75 watt tubular fluorescent lamp which is 96 inches in length and one and a half inches in diameter, and conforms to ANSI C78.81 (Data Sheet 7881-ANSI-3007-1) (incorporated by reference; see § 430.3).

1.7 *F96T12HO lamp* means a nominal 110 watt tubular fluorescent lamp that is 96 inches in length and one and a half inches in diameter, and conforms to ANSI C78.81 (Data Sheet 7881-ANSI-1019-1) (incorporated by reference; see § 430.3).

1.8 *F34T12 lamp* (also known as a “F40T12/ES lamp”) means a nominal 34 watt tubular fluorescent lamp that is 48 inches in length and one and a half inches in diameter, and conforms to ANSI C78.81 (Data Sheet 7881-ANSI-1006-1) (incorporated by reference; see § 430.3).

1.9 *F96T12/ES lamp* means a nominal 60 watt tubular fluorescent lamp that is 96 inches in length and one and a half inches in diameter, and conforms to ANSI C78.81 (Data Sheet 7881-ANSI-3006-1) (incorporated by reference; see § 430.3).

1.10 *F96T12HO/ES lamp* means a nominal 95 watt tubular fluorescent lamp that is 96 inches in length and one and a half inches in diameter, and conforms to ANSI C78.81 (Data

Sheet 7881-ANSI-1017-1) (incorporated by reference; see § 430.3).

1.11 *Input current* means the root-mean-square (RMS) current in amperes delivered to a fluorescent lamp ballast.

1.12 *Luminaire* means a complete lighting unit consisting of a fluorescent lamp or lamps, together with parts designed to distribute the light, to position and protect such lamps, and to connect such lamps to the power supply through the ballast.

1.13 *Nominal lamp watts* means the wattage at which a fluorescent lamp is designed to operate.

1.14 *PLC control signal* means a power line carrier (PLC) signal that is supplied to the ballast using the input ballast wiring for the purpose of controlling the ballast and putting the ballast in standby mode.

1.15 *Power Factor* means the power input divided by the product of ballast input voltage and input current of a fluorescent lamp ballast, as measured under test conditions specified in ANSI C82.2 (incorporated by reference; see § 430.3).

1.16 *Power input* means the power consumption in watts of a ballast a fluorescent lamp or lamps, as determined in accordance with the test procedures specified in ANSI C82.2 (incorporated by reference; see § 430.3).

1.17 *Relative light output* means the light output delivered through the use of a ballast divided by the light output of a reference ballast, expressed as a percent, as determined in accordance with the test procedures specified in ANSI C82.2 (incorporated by reference; see § 430.3).

1.18 *Residential building* means a structure or portion of a structure which provides facilities or shelter for human residency, except that such term does not include any multifamily residential structure of more than three stores above grade.

1.19 *Standby mode* means the condition in which an energy-using product—

(a) Is connected to a main power source; and

(b) Offers one or more of the following user-oriented or protective functions:

(i) To facilitate the activation or deactivation of other functions (including active mode) by remote switch (including remote control), internal sensor, or timer.

(ii) Continuous functions, including information or status displays (including clocks) or sensor-based functions.

1.20 *Wireless control signal* means a wireless signal that is radiated to and received by the ballast for the purpose of controlling the ballast and putting the ballast in standby mode.

2. Test Conditions.

2.1 *Measurement of Active Mode Energy Consumption, BEF.* The test conditions for testing fluorescent lamp ballasts shall be